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PROGRESS REPORT
of the
Range Improvement Study
in the
Crystal Springs Range Demonstration Area



Prepared for
BOARD OF SUPERVISORS
Pahranagat Valley Soil Conservation District

By the
Soil Conservation Service*
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INTRODUCTION AND HISTORY

The Crystal Springs Range Demonstration Area, presently known as the Crystal Springs Range Conservation Practice Study Area, is in Pahranaagat Valley, Lincoln County, Nevada. A range study area was first suggested in 1935 by the Crystal Springs Soil Conservation Association. The objectives of establishing a study area were to:

1. Re-establish and maintain a vegetative cover of high forage value that would prevent accelerated erosion, conserve the moisture supply and add to the fertility of the soil.
2. Demonstrate methods of utilizing the range forage crop to the fullest extent possible consistent with sustained forage production.
3. Demonstrate to the local people methods of controlling erosion by range management.

As a result of this interest, 16,210 acres of public domain range land, located on the west side of Pahranaagat Valley, were withdrawn by Presidential Executive Order in February 1937.

In the spring of 1937, 7,850 acres were fenced for the range conservation practice study and the remainder of the 16,210 acres were left unfenced. The northern and western 3,180 acres of the fenced area have a vegetative cover of blackbrush. The remaining 4,670 acres of range in the southern and eastern part of the fenced tract have a vegetative cover of grasses and shrubs, which is the source of usable forage.

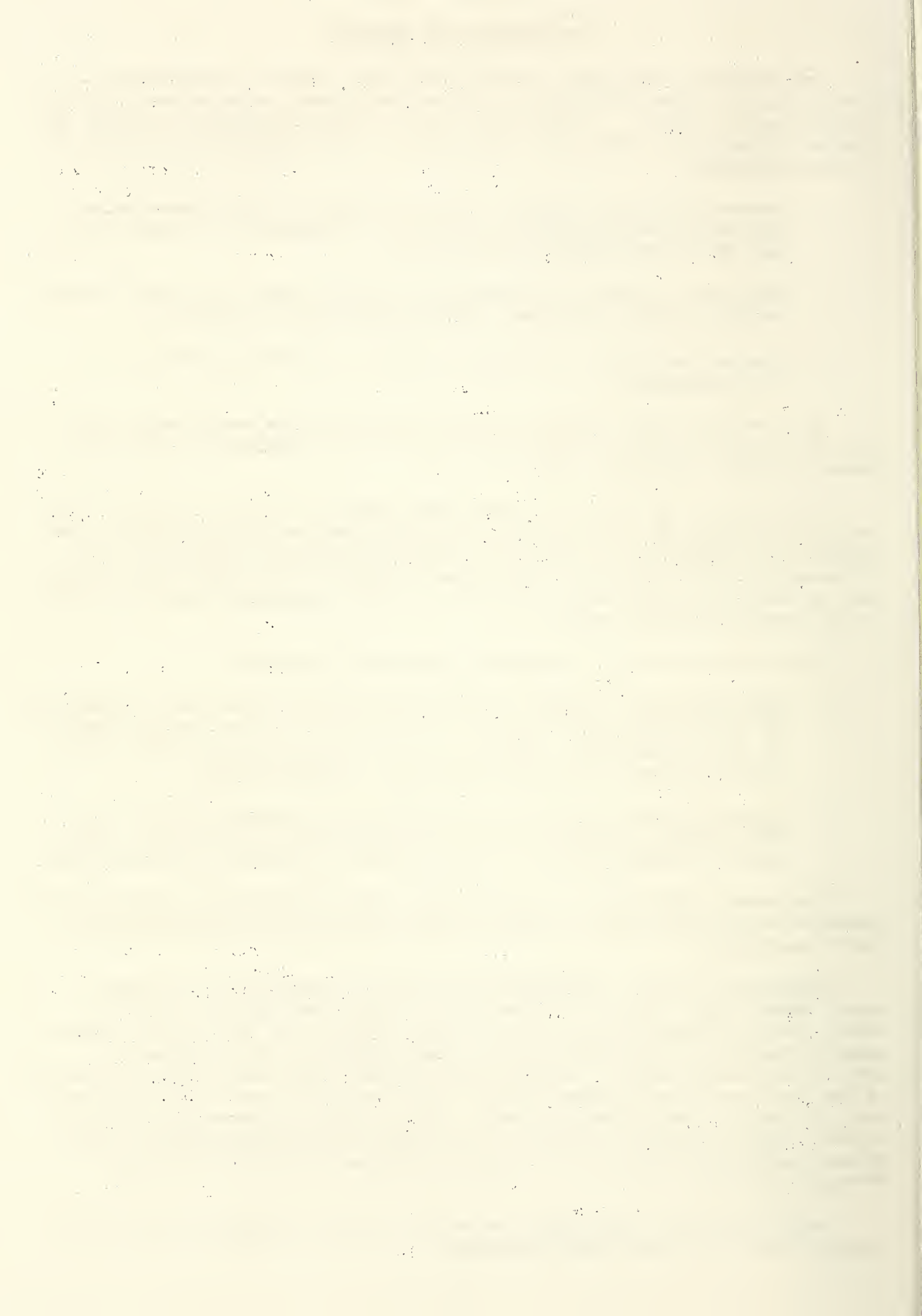
The following two major vegetative types are recognized:

1. Saltbrush type, located in the southeast part of the area. Vegetation in this area consists mainly of such plants as Galleta Grass, Indian Ricegrass, Bush Muhly, Nevada Jointfir, Spiny Hopsage, White Burrow-brush, Wolfberry, Four-wing Saltbrush, and Rabbitbrush.
2. Blackbrush type, located in the northern and western part of the fenced area. Vegetation consists mainly of Blackbrush with a small amount of Nevada Jointfir, Spiny Hopsage, Wolfberry, and Rabbitbrush.

The fenced study area is located between the southern desert shrub and the northern desert shrub belts, in what is recognized as the Hopsage-Blackbrush plant association.

Shrubs and grasses, characteristic of both the northern and southern desert shrub belts, grow in association with each other in this transition zone. Indian Ricegrass was probably the most abundant of the northern desert grasses present in the original cover. Only remnants of this species are left in the present cover. Galleta Grass and Bush Muhly were the most abundant of the southern desert grasses present in the original cover. These grasses are prominent in the present-day cover. The mixture of northern-desert (cool-season) plants growing in association with the southern-desert (warm season) plants, seriously complicates the grazing management necessary for range forage improvement.

Soils within the fenced area are mostly gravelly, sandy loam underlain at varying depth by a lime-cemented hardpan.



This study area is representative of several million acres of rangeland in southwestern Utah, southern Nevada, and western Arizona.

The range lands in this part of southern Nevada were first grazed by domestic livestock about 1870. The use of the range was free and open to all with no restrictions on number or time of grazing until 1940. In 1940 the territory north of the study area was included in a Grazing District with grazing controlled by the Grazing Service. South of the study area, which is outside the Grazing District, unrestricted use continues. Current grazing practices in the immediate vicinity of the study area show a decrease in the intensity of use, but little change in the seasons of use and management methods. Livestock numbers grazing this range began increasing about 1900 and reached a maximum number about 1920. By 1930 range forage production had sharply declined throughout this area. The severe depletion of the native cover permitted serious soil losses through both wind and water erosion. Extremes in weather conditions and recurring prolonged droughts accelerated the range depletion.

The ranchers are dependent on this desert range for winter and spring grazing through the month of April. This includes most of the short spring growing season of the northern-desert, cool-season forage plants.

The need for early spring grazing on this range confronts the local stockmen with the problem of finding and using range management practices which will enable them to graze their range during the winter and early spring, and at the same time, bring about range forage improvement.

CONDUCT OF STUDY

Weather Records

Precipitation records have been kept on the study area since 1937. Complete precipitation records are available since 1939 except for the years 1947 and 1951. Average yearly precipitation is 6.54 inches. Some precipitation falls normally during each month of the year, but most of it occurs during two periods, from December to April, and from July to August. The table on page 3 shows the monthly distribution of precipitation as measured on the east end of the study area.

Surveys

The original range survey and vegetation type map of the Range Conservation Practice Study Area was made in 1936 by Soil Conservation Service technicians. The ocular reconnaissance method of range survey was used. This method of survey was not considered adequate enough to record the yearly changes in vegetation.

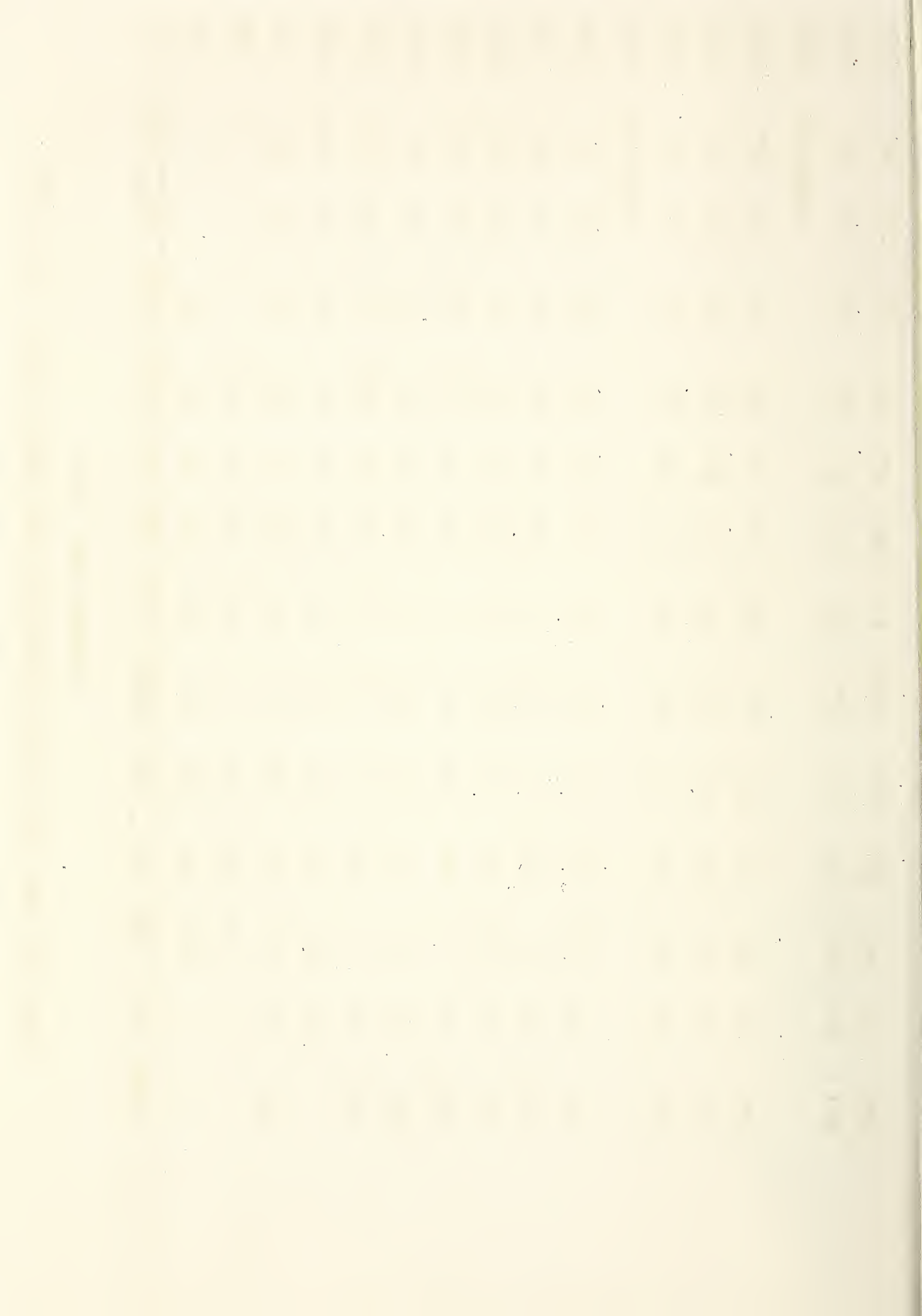
In 1937 the square-foot density method of survey was adopted to enable making more definite measurements and observation of vegetation at yearly intervals. A mechanical grid system was laid out on a reproduction of the original range-type map. At locations selected on this one-quarter mile grid permanently located plots were established in the area. Plots were not located at each grid intersection, but were omitted where vegetative composition and condition were uniform within the type and the type was considered adequately sampled. Recordings of plant density and species composition on each of the permanent plots were made annually from 1937 to 1941 and repeated again in 1946.



PRECIPITATION - CRYSTAL SPRINGS RANGE CONSERVATION PRACTICE STUDY AREA, FIKO, NEVADA

EAST 5 ACRE ENCLOSURE

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	TOTAL
1937	-	-	.84	.00	.00	.00	.55	.52	.00	.00	.00	-	-
1938	-	-	-	1.78	.61	1.70	1.96	.14	.40	.06	1.26	-	
1939	.54	.31	.37	.82	.39	.00	.90	.66	1.90	.31	.54	.06	6.80
1940	2.94	.00	1.60	.05	.36	.02	.00	.47	.35	.15	.85	7.71	
1941	1.00	1.52	2.34	2.67	.18	.91	1.02	1.17	.10	2.28	.01	.94	14.14
1942	.00	.14	1.29	.03	.10	.00	.14	.48	.00	.00	.00	.27	2.45
1943	1.24	1.34	1.56	1.99	.00	.25	.15	.10	1.27	.31	.31	1.67	10.20
1944	1.99	1.18	.30	.27	.75	.00	.00	.00	.00	.14	1.44	.18	5.26
1945	.16	.74	.37	.65	.46	.18	.83	4.70	.03	1.67	.11	.18	10.08
1946	.71	.01	.48	.12	.49	.00	.91	.08	.00	1.25	2.28	.73	7.06
1947	NO RECORD												
1948	.00	.10	.00	.53	.00	.78	.00	.00	.00	.40	.00	.18	1.99
1949	.00	.00	.00	.00	2.52	.47	.77	.01	.00	.75	.32	.27	5.11
1950	.15	.24	.00	.00	.00	.00	1.58	.39	.08	.00	.40	.00	2.84
1951	NO RECORD												
1952	1.66	.03	2.49	.35	.39	.00	.43	.45	.15	.00	.00	1.65	7.60
1953	.00	.45	.37	.00	.00	.00	1.07	1.37	.00	.80	.00	.15	4.21



In 1953 recordings of plant density and species composition were made on representative plots in the major types within the fenced area.

Standard procedures, formulated by the Inter-Agency Western Range Survey Committee, have been followed in making the surveys and recordings of composition and density. The surveys and recordings were made in the fall or early winter when vegetation was mature and before the area was grazed.

Amount and Season of Grazing

Grazing capacities calculated from the 1936 and 1937 range surveys were used as guides when the area was first stocked in 1939. Thereafter, utilization checks of the vegetation and grazing records were used to determine season and amount of use for each grazing year.

An attempt has been made to graze the fenced area only during the winter season. Livestock grazing the area has been confined to cattle since the fence was constructed. Stocking rates and dates of grazing are shown on page 16.

Conservation Practices

In 1936, eleven water pockets were constructed on the area to control runoff and provide a source of stock water. Contour spreader ditches were also constructed in the area to lead runoff into the water pockets and spread the excess water over the range. In the winter of 1940-1941, a well was drilled and a windmill and concrete water tank installed to supply permanent stockwater.

Several seeding trials, using numerous seeding mixtures and species, were carried out on the area during the spring of 1936 and winter of 1937. These seedings were made by broadcasting and raking in by hand or broadcasting on the snow. See table on page 17 for the species used.

RESULTS

The following tables and photographs were compiled at intervals during the study. They show plant density, composition and forage production changes that have taken place on the area prior to 1954. Three different plots are illustrated to represent the important range types within the fenced area. The first series of three photos and Table I is of plot R6 in the Galleta grass, Nevada Jointfir, and Spiny Hopsage type. This area was cleared of brush for the construction of a water pocket in 1937. This is a rectangular plot of 100 square feet in area. Recordings of plant density and species composition were made annually from 1938 to 1941, again in 1946 and in 1953. Recordings were made of the square feet of ground surface covered by each plant species, the number of plants, and the average height of plants.

The second series of three photos and Table II is a representative sample of the Galleta Grass, and Nevada Jointfir, and Spiny Hopsage type that was not cleared of brush. Most of the forage is produced on the range type represented by this plot. Recordings of plant density and species composition were made in this 200 square foot circular plot annually from 1938 to 1941 and again in 1953.

The third series of photos and Table III represent the Blackbrush type. This is a 100 square foot rectangular plot. The time of recording plant density and species composition on this plot was identical to the first series.



GALLETA GRASS, NEVADA JOINTFIR AND SPINY HOPSAGE TYPE ! PLOT R6
AREA CLEARED OF BRUSH IN 1937.



Photo taken in 1938
Total density 9.25 sq. ft.
per 100 sq. ft.
Estimated lbs. of
usable forage:
50 lbs. per acre.
1938 rainfall 7.91
(record incomplete)



Photo taken in 1946
Total density 18.13 sq. ft.
per 100 sq. ft.
Rainfall: 10.08
1945 annual rainfall: 7.06
No record of usable forage made.



Photo taken in 1953.
Total density 11.94 sq. ft.
per 100 sq. ft.
Forage production by plot
clippings and weights
177 lbs. of usable
forage per acre.
1953 annual rainfall 4.21



TABLE I

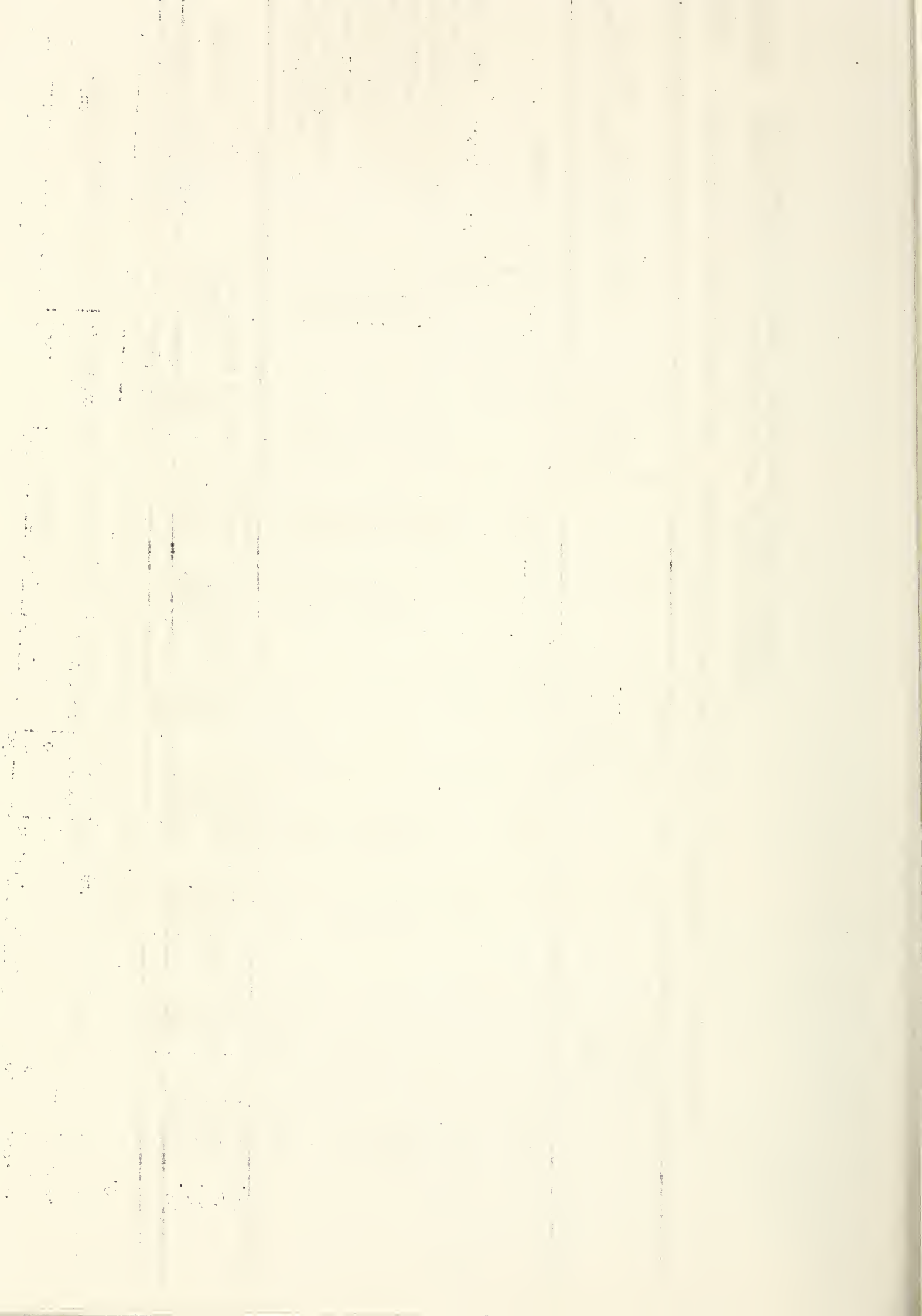
Galleta Grass, Nevada Jointfir, Spiny Hopsage Type - Area Cleared of Brush in 1937 - Plot R6

Ground Surface Covered by Vegetation (Square feet per 100 Square Feet)

Year	Species	1938				1946				1953			
		Ave. Height in Inches	No. of Plants	Sq.Ft. of Ground Cover	Ave. Height in Inches	No. of Plants	Sq.Ft. of Ground Cover	Ave. Height in Inches	No. of Plants	Sq.Ft. of Ground Cover	Ave. Height in Inches	No. of Plants	Sq.Ft. of Ground Cover
Galleta Grass Indian Ricegrass Four-O'Clock Nevada Jointfir Anderson Wolfberry Fourwing Saltbrush Goldenhead (Shockley) White Burrowbrush Loco Weed		18	135	5.00	12	199	14.69	14	208	10.01			
		14	7	.50	8	5	.44						
		12	1	.50				13	1	.60			
		18	1	.75	20	1	.56	6	3	.86			
		12	2	1.00	8	3	.85	10	1	.25			
		12	1	1.00	16	1	1.10	4	1	.20			
		6	1	.25	6	1	.49						
		8	1	.25				2	1	.02			
Total				9.25			18.13			11.94			
Precipitation for year For June, July, and August			7.91+			7.06			4.21				
Precipitation previous year			3.80			.99			2.44				
						10.08			7.60				

Soils The soils in this site are light textured, about two feet deep, and underlain by a lime hardpan.

Erosion Water erosion is moderate with some gullyng occurring.
Wind erosion is slight, leaving some desert pavement.



Comparison of Ground Cover and Plants by Years for
Galleta Grass-Nevada Jointfir-Spiny Hopsage Type-Cleared of Brush.

In 1938, 9.25 square feet per hundred square feet of the ground surface was completely covered with vegetation. When recordings on the plot were made in 1946, the density had increased to 18.13 square feet and in 1953 had decreased to 11.94 square feet following five years of severe drought. The change in ground cover by different plants is as follows:

- Grasses: Galleta grass - increased from 5.00 square feet per hundred square feet in 1938 to 14.69 square feet in 1946, but decreased to 10.01 square feet in 1953. This is still twice the amount of ground cover that was recorded in 1938.
Indian Ricegrass - made up .50 of a square foot in 1938, decreased to .44 of a square foot in 1946, and was not present in 1953.
- Forbs: Four O'clock occupied .50 of a square foot in 1938, but was not present in 1946 or 1953.
- Shrubs: Shockley Goldenhead - occupied .25 of a square foot in 1938, increased to .49 of a square foot in 1946, then decreased to .20 of a square foot in 1953.
Nevada Jointfir - occupied .75 of a square foot in 1938, decreased to .56 of a square foot in 1946, then increased to .60 of a square foot in 1953.
Fourwing Saltbrush - occupied 1.00 square foot in 1938, increased to 1.1 square foot in 1946, and decreased to .25 of a square foot in 1953.
Anderson Wolfberry - occupied 1 square foot in 1938, decreased to .85 of a square foot in 1946, and was about the same in 1953 - .86 of a square foot.
White Burrowbrush - occupied .25 of a square foot in 1938 and was not present in 1946 or 1953.

Weights obtained from plot clippings made in 1953 on the area, cleared of brush in 1937, indicate a yield of 177 pounds of usable forage per acre. This is 127 pounds per acre increase in forage production over the estimated yield (50 pounds per acre) in 1938, even though the annual rainfall in 1937 was estimated at 9.62 inches and the annual rainfall in 1953 was 4.21 inches following several years of particularly low rainfall. This is an indication of increased forage production that may be obtained where brush is eliminated and the available moisture utilized by the grasses.



- 2 -

GALLETA GRASS, NEVADA JOINTFIR, SPINY HOPSAGE AREA
NOT CLEARED OF BRUSH.



Photo taken 1938
Total density 2.5 sq. ft.
per 200 sq. ft.
Est. Forage production:
50 lbs. usable forage per acre.
1937 annual rainfall 9.62



Photo taken 1941
Total density 3.36 sq. ft.
per 200 sq. ft.
No estimate of forage
production made.
1940 annual rainfall 7.71



Photo taken 1953
Total density 12.45 sq. ft.
per 200 sq. ft.
Forage production by
plot clippings and weights:
150 usable forage per acre
Annual rainfall 1952: 7.60

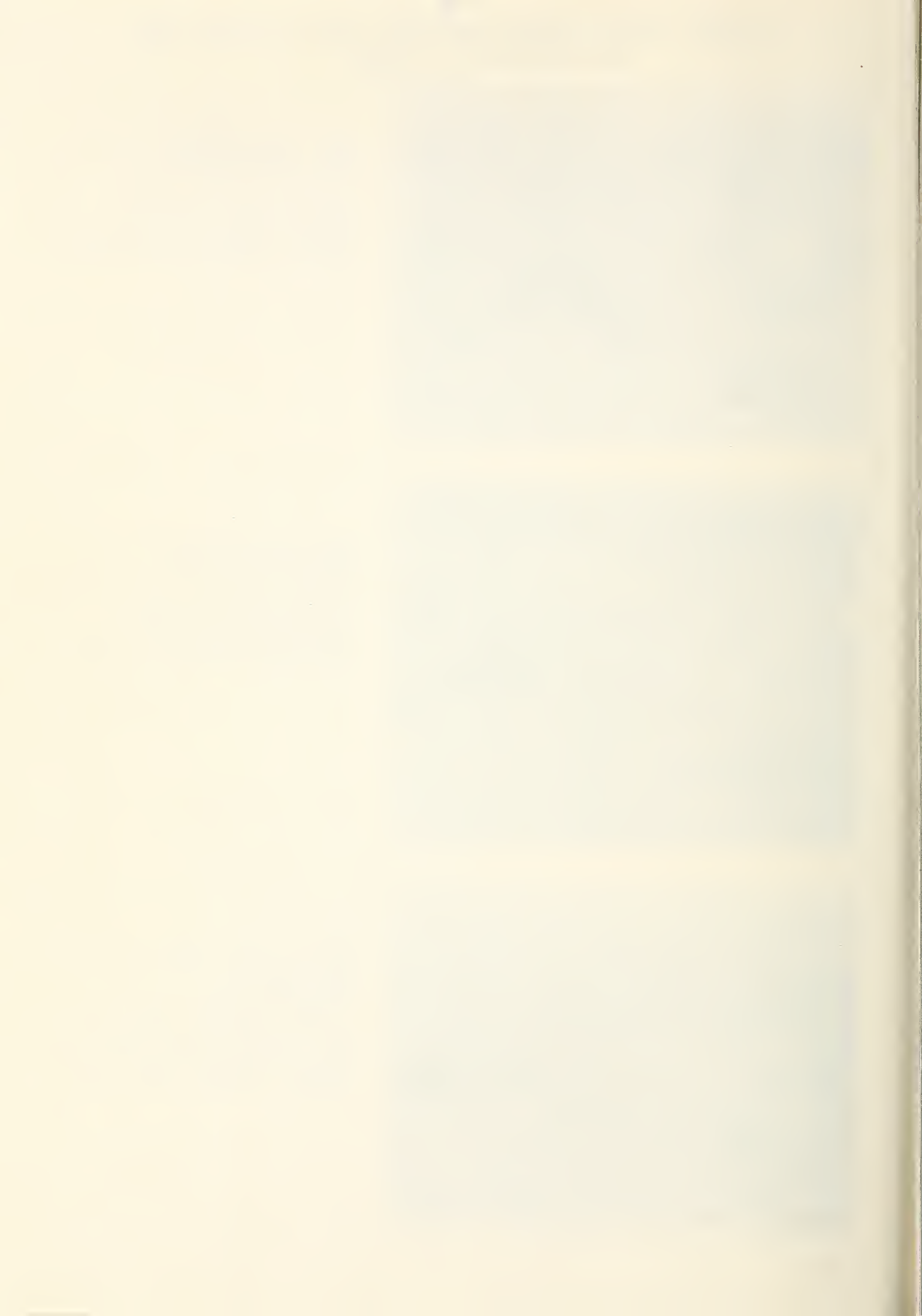
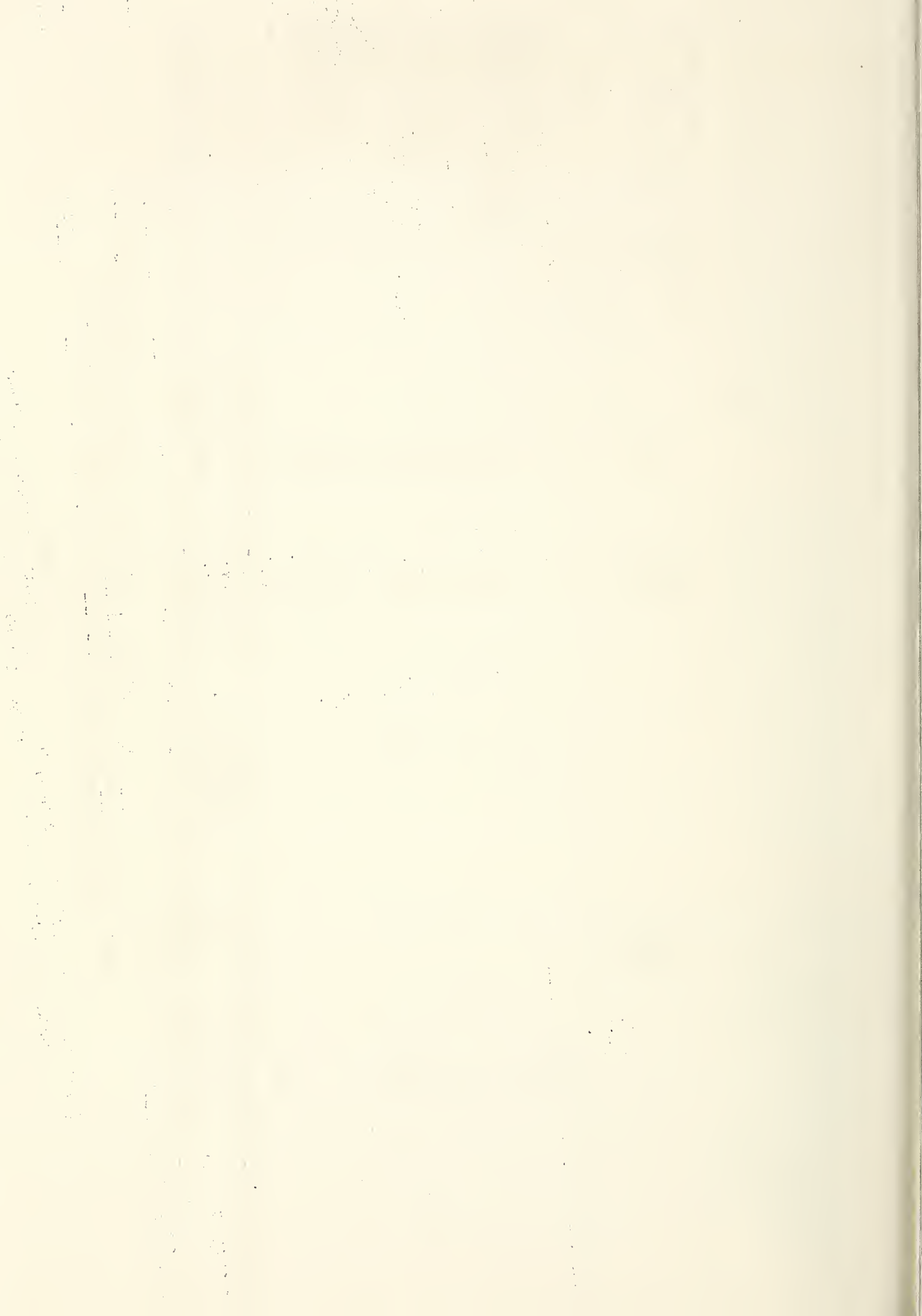


TABLE II

Galleta Grass, Nevada Jointfir Type - Not cleared of brush
Ground Surface Covered by Vegetation (Square feet per 200 square feet)

Year	1938	1941	1953		
Species	Square feet of Ground Cover	Square feet of Ground Cover	Average height of plants in inches	Number of Plants	Square feet of Ground Cover
Galleta Grass	.50	.88			9.90
Fluffgrass	.13				
Globemallow	.12	.25			
Loco	.12				
Four O Clock	.12				
Hopsage Spiny	.13	.50	16	2	.75
Nevada Jointfir	.50	.50	12	1	1.00
Burrowbrush	.13	.36			
Anderson Wolfberry	.25	.25	8	3	.60
Shockley Goldenhead	.36	.50			
Four-wing Saltbrush	.14	.12			
Rabbitbrush			8	1	.20
TOTAL	2.50	3.36			12.45

Precipitation for year	7.91	14.14	4.21
For June - July - August	3.80	3.10	2.44
Precipitation previous year		7.71	7.60



Comparison of Ground Cover and Plants by Years for
Galleta Grass-Nevada Jointfir-Spiny Hopsage Type - Not Cleared of Brush

In 1938, 2.50 square feet per 200 square feet of the ground surface was completely covered with vegetation. When the plot was recorded in 1941, the density had increased to 3.36 square feet and to 12.45 square feet by 1953.

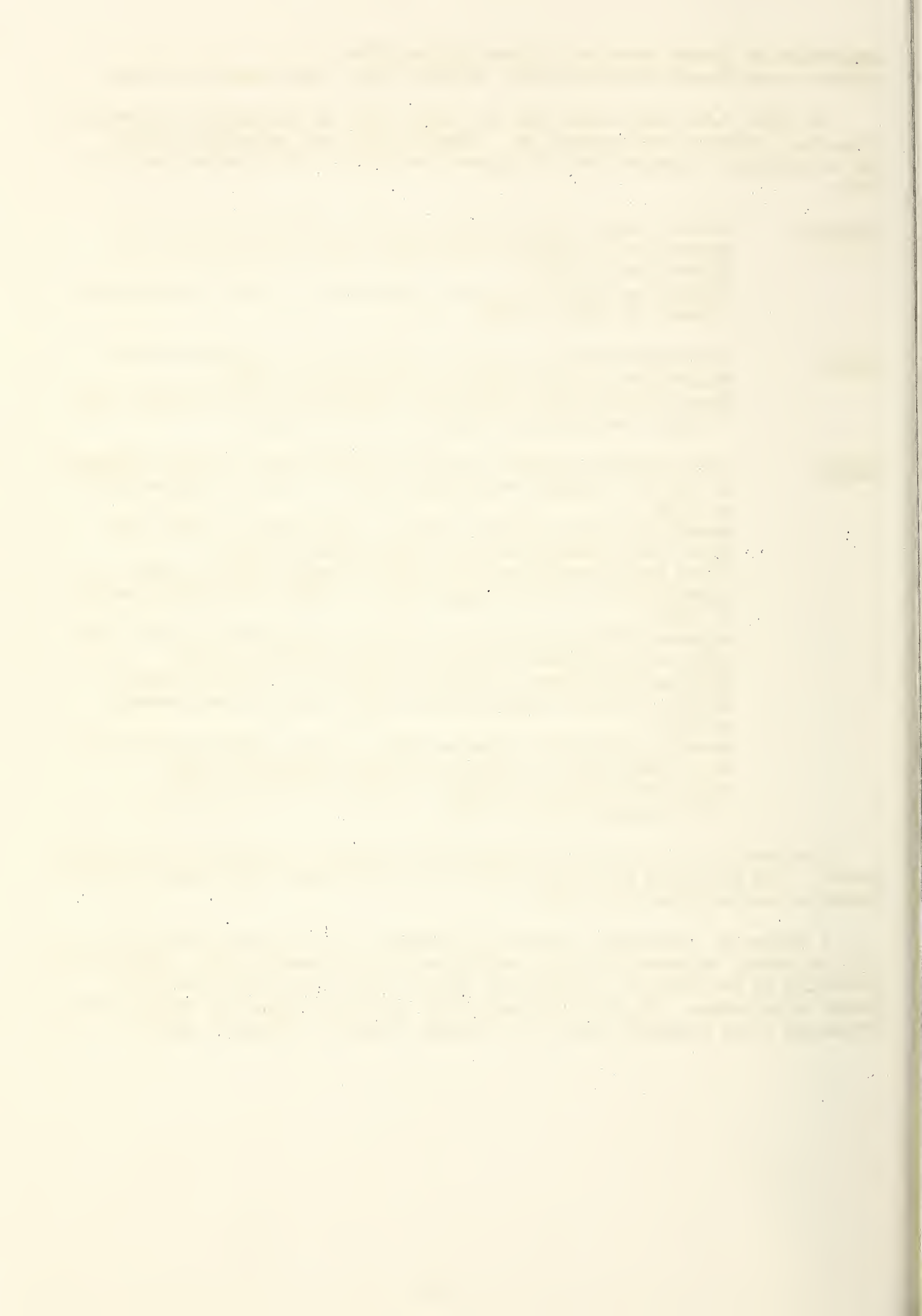
Grasses: Galleta Grass increased from .50 of a square foot per 200 square feet in 1938 to .88 square foot in 1941 and to 9.9 square feet in 1953.
Fluffgrass made up .13 of a square foot in 1938 but was not present in 1941 or 1953.

Weeds: Globemallow made up .12 of a square foot in 1938, .25 of a square foot in 1941 and was not present in 1953.
Loco Weed and Four O'Clock each occupied .12 of a square foot in 1938, but were not present in 1941 or 1953.

Shrubs: Spiny Hopsage occupied .13 of a square foot in 1938, increased to .50 of a square foot by 1941 and to .75 of a square foot by 1953.
Nevada Jointfir occupied .50 of a square foot in 1938 and 1941, but increased to 1.00 square foot by 1953.
White Burrowbrush occupied .13 of a square foot in 1938, increased to .36 of a square foot by 1941 but was not present in 1953.
Anderson Wolfberry occupied .25 of a square foot in 1938 and 1941, and increased to .60 of a square foot by 1953.
Shockley Goldenhead increased from .36 of a square foot in 1938 to .50 of a square foot in 1941, but was not present in 1953.
Fourwing Saltbrush decreased from .14 of a square foot to .12 of a square foot in 1941 and was not present in 1953.
Rabbitbrush was not present in 1938 or 1941 but made up .20 of square foot in 1953.

The forage of this plot was clipped and weighed in 1953 to obtain forage yields. The clippings showed the plot to be producing at the rate of 150 pounds of usable forage per year.

A series of plots were clipped and weighed over the entire type in 1953 to obtain an average forage production for the fenced area. The area was producing at the rate of 75 pounds of usable forage per acre with 4.21 inches of moisture. In 1938 the same area, with 9.62 inches of moisture was producing at an estimated rate of 31 pounds of usable forage an acre.



-00-

BLACK BRUSH AREA



Photo taken in 1938.
Total density 16.25 sq. ft.
per 100 sq. ft.
No usable forage
1938 annual rainfall: 7.91



Photo taken in 1946
Total density 20.10 sq. ft.
per 100 sq. ft.
No usable forage
1946 annual rainfall: 7.06



Photo taken in 1953.
Total density 9.95 sq. ft.
per 100 sq. ft.
1953 annual rainfall: 4.21

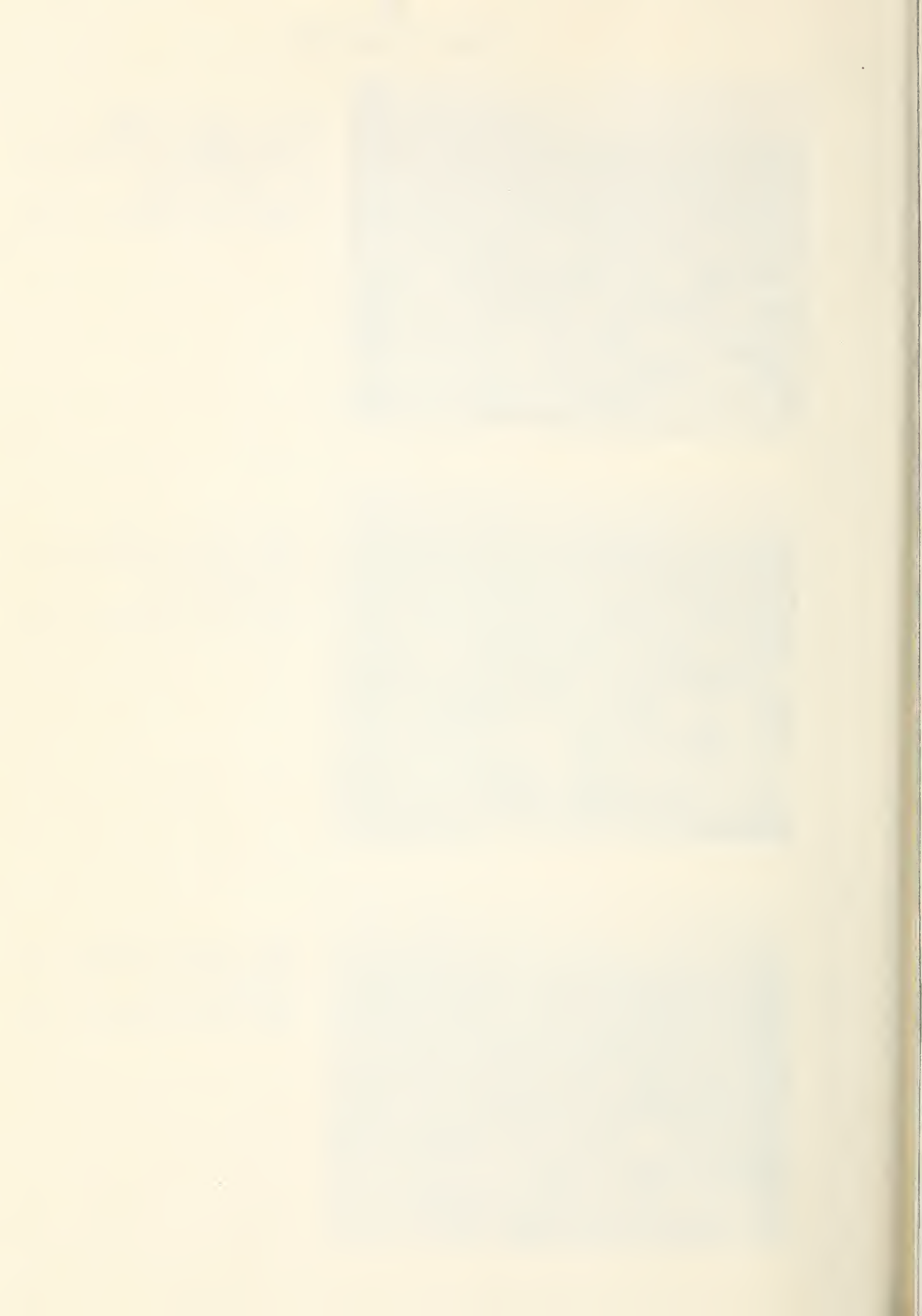


TABLE III
Blackbrush Type

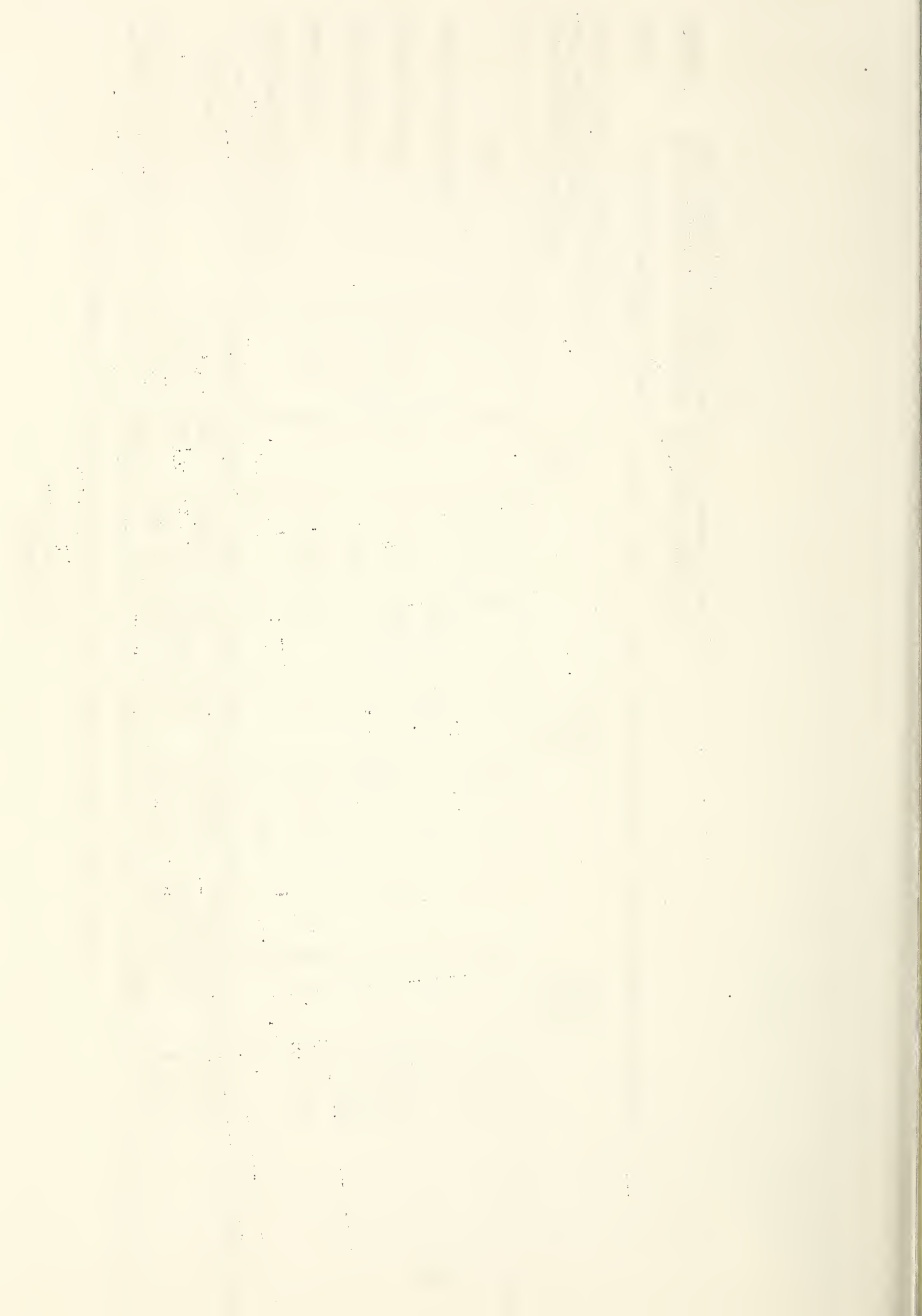
Ground Surface Covered by Vegetation (Square feet per 100 Square Feet)

Year	1938			1946			1953		
	Ave. Height in Inches	No. of Plants	Sq. Ft. of Ground Cover	Ave. Height in Inches	No. of Plants	Sq. Ft. of Ground Cover	Ave. Height in Inches	No. of Plants	Sq. Ft. of Ground Cover
Bottlebrush Squirreltail				6	2	.02			
Blackbrush	16	6	9.25	21	8	11.89	22	6	6.95
Spiny Menodora	4	1	1.00	4	1	.88	5	1	1.00
Nevada Jointfir	20	3	6.00	26	4	7.10	18	3	2.00
Anderson Wolfberry				12	1	.21			
TOTAL			16.25			20.10			9.95

Precipitation for year	7.91	7.06	4.21
For June-July-August	3.80	.99	2.44
Precipitation for previous year		10.08	7.60

Soils Are light textured, rocky, about 10 inches in depth and underlain by lime cemented hardpan.

Erosion Water erosion is moderate, with some gullying.
Wind erosion is slight, causing a desert pavement.



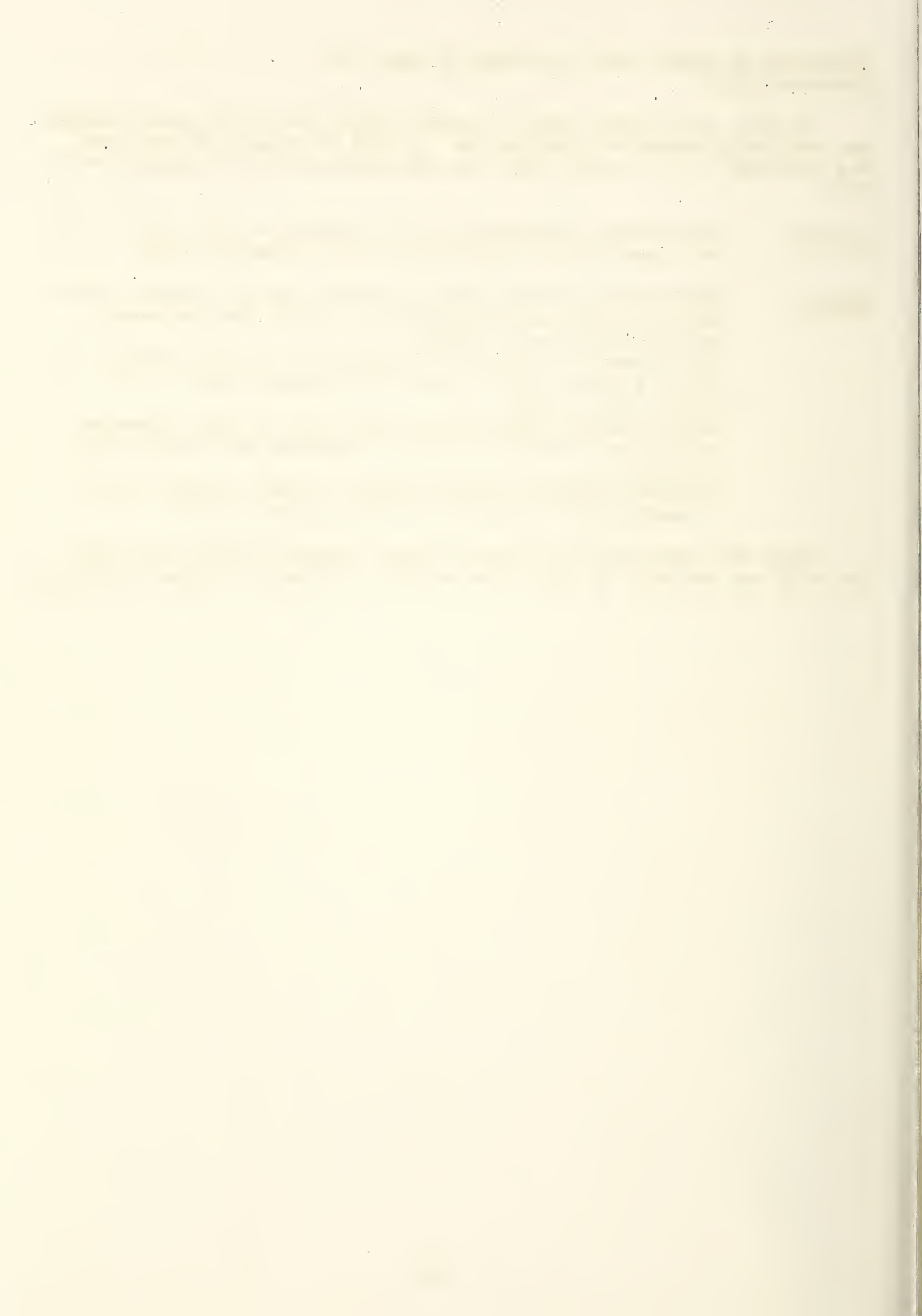
Comparison of Ground Cover and Plants by Years for
Blackbrush Type.

In 1938, 16.25 square feet per hundred square feet of the ground surface was completely covered with vegetation. By 1946 the density on this plot had increased to 20.10 square feet, but had decreased to 9.95 square feet by 1953.

Grasses: Bottlebrush Squirreltail was not present in 1938, made up .02 of a square foot in 1946, and was not present in 1953.

Shrubs: Blackbrush increased from 9.25 square feet per hundred square feet in 1938 to 11.89 square feet in 1946, then decreased to 6.95 square feet by 1953.
Spiny Menodora occupied 1.0 square foot in 1938, decreased to .88 of a square foot by 1946, and increased back to 1.00 square foot by 1953.
Nevada Jointfir made up 6.00 square feet in 1938, increased to 7.10 square feet by 1946, but decreased to 2 square feet by 1953.
Anderson Wolfberry was not present in 1938, covered .21 of a square foot in 1946, and was not present in 1953.

There was practically no livestock forage produced on this area when the study was started. To date there has been no change in forage production.



CONCLUSIONS

Spreader Ditches

Maintenance of the grade ditches was stopped in 1939. The results being obtained did not appear to justify the expense.

Seeding Results

Of the several species of grasses planted only a few scattered plants of crested wheatgrass had survived by 1945. By 1953 the few crested wheatgrass plants had disappeared.

Artificial seeding in this low rainfall area with species and methods used was not successful.

Stocking

The fenced area has been stocked and grazed with cattle during a seasonal period starting as early as December 12 and ending as late as April 30. The growing season for the cool season range forage is March 1 to May 15 under normal climatic conditions. Such warm season plants as Galleta Grass and Bush Muhly grow during the summer months. Optimum conditions for range forage production would, therefore, involve no grazing after March 15 if the cool season plants are to survive. An evaluation of the data included in this report must, therefore, give consideration to the fact that during only five out of the fourteen years has grazing ceased by March 15.

Management

The information obtained by this study to date suggests a number of practical improvements in management that may be expected to increase range forage production and control erosion throughout the Pahranaagat Valley Soil Conservation District.

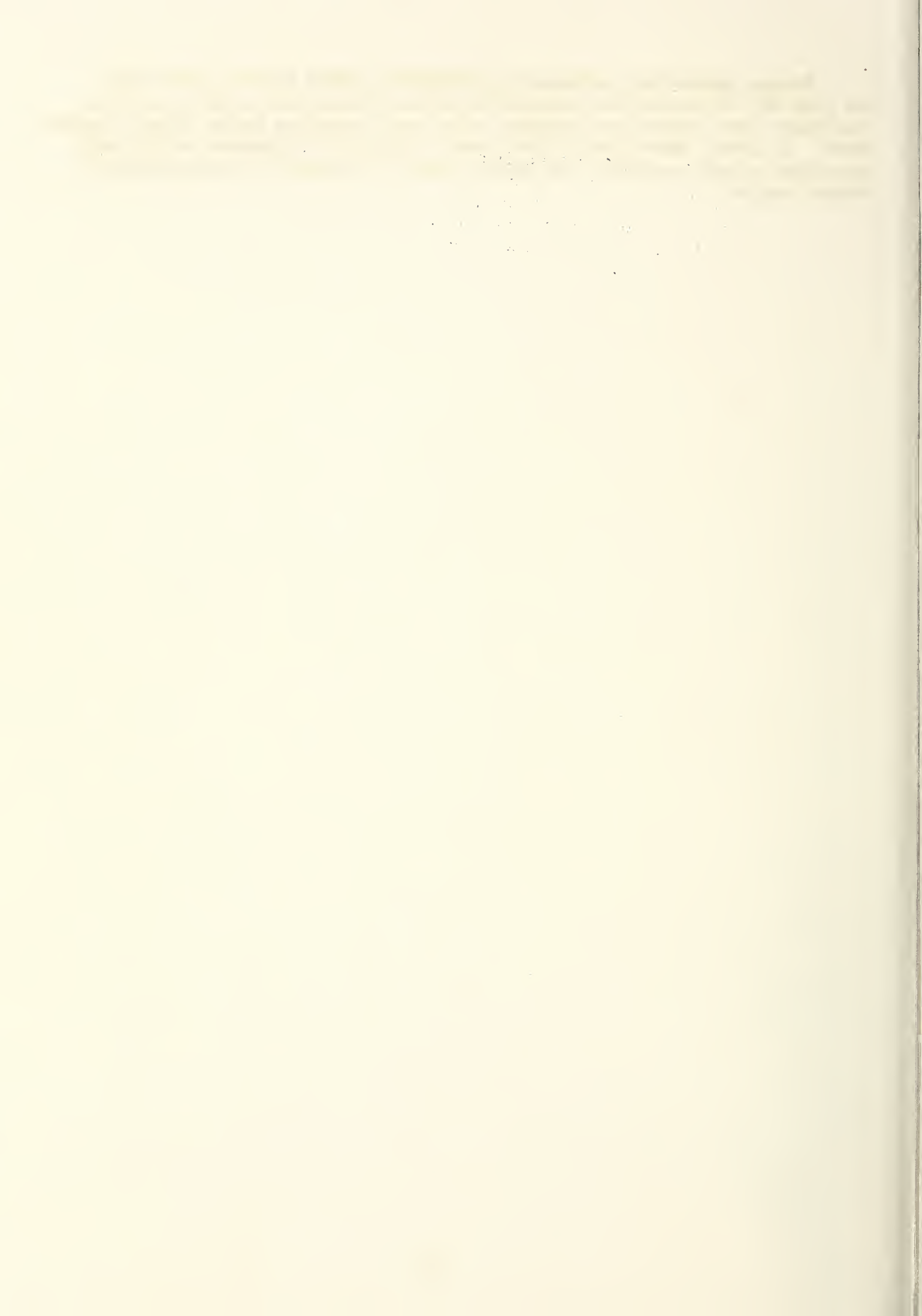
The amount of range use needs to be adjusted to the forage produced each year. This is brought out by the loss of ground cover during the low forage drought years.

The data indicates that a management system which will rotate the time of use in such a manner as to allow the important cool season forage plants to complete their growth two out of three years is a practical answer to improved forage production on this type of desert range. It is known that the important range forage species, if grazed throughout their growing season every year, will decline in the yield of forage and will eventually be replaced by unpalatable plants.

Forage produced by such warm season plants as Galleta Grass and Bush Muhly increased two and one half times from 1938 to 1953. During the same period the forage produced by cool season plants such as Indian Ricegrass declined. The decreased production of the cool season plants is attributed to the fact that winter grazing continued through the critical spring growing period nine of the fifteen years of the study. There was no grazing during the summer growing season.



Forage production increased approximately three and one half times on Plot R6, which had been cleared of brush. Results from this one plot indicate brush control on selected sites would speed-up range forage improvement. In areas where part of the cover is made up of grasses, additional moisture is made available for grass growth by control of the unpalatable brush species.



GRAZING AND PRECIPITATION RECORD

1939 to 1952

Year	Precipitation	Dates of Use	Animal Unit Months of grazing harvested
1939	6.80	December 15, 1939 to March 20, 1940	231
1940	7.71	December 12, 1940 to March 3, 1941	245
1941	14.14	January 7, 1942 to April 14, 1942	182
1942	2.45	February 7, 1943 to April 3, 1943	206
1943	10.20	December 23, 1943 to April 10, 1944	192
1944	5.26	December 23, 1944 to April 11, 1945	330
1945	10.08	November 30, 1945 to April 10, 1946	304
1946	7.06	December 1, 1946 to February 18, 1947	111
1947	*2.70	January 28, 1948 to April 29, 1948	288
1949	1.99	(No use - lack of water)	
1950	4.52	February 28, 1950 to April 30, 1950	30
1951	*2.88	February 28, 1951 to April 30, 1951	240
1952	7.60	(No use - drought, no regrowth after spring grazing)	
1953	4.21	January 14, 1952 to March 11, 1953	151**

*Estimated

**Very little forage taken from Area - 23 tons of hay and 6,800 pounds of cottonseed meal were fed while cattle were on the area.

List of Species of Grass Used in Seeding Trials on Study Area

<u>Scientific Name</u>	<u>Common Name</u>
Elymus condensatus	Giant Wild-rye (California origin)
Elymus condensatus	Giant Wild-rye (Nevada origin)
Agropyron smithii	Bluestem Wheatgrass
Agropyron cristatus	Crested Wheatgrass
Koelria cristata	Junegrass
Poa scabrella	Pine Bluegrass
Bouteloua gracilis	Blue Grama Grass
Hilaria jamesi	Galleta Grass
Festuca idahoensis	Idaho Fescue
Poa bulbosa	Bulbous Bluegrass
Bromus inermis	Smooth Brome Grass
Agropyron pauciflorum	Slender Wheatgrass
Sporobolus airoides	Alkali Sacaton
Oryzopsis hymenoides	Indian Ricegrass
Sporobolus wrightii	Sacaton

